

**THE SETIVENTRIS-COMPLEX IN THE GENUS HYLEMYA ROB.  
DESV., WITH DESCRIPTIONS OF NEW SPECIES AND SUB-  
SPECIES FROM NORTH AMERICA**

(DIPTERA, MUSCIDAE)

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The species *Hylemya setiventris* was described by Stein (1898)<sup>1</sup> in his first notable contribution to the anthomyid fauna of North America from specimens taken at Moscow, Idaho, by Dr. J. M. Aldrich. The types are deposited in the United States National Museum. The male is distinguished readily from its congeners by the striking character of the fourth abdominal sternum.<sup>2</sup> The integument comprising the inner caudal region of this sclerite is membranous and is sunken or collapsed, thus forming a broad rounded emargination with lamella-like processes protruding caudal from each side. The lamellae have at their caudal extremity a dense assemblage of long slender bristles that extend caudad and curve mesad at tips beneath the hypopygium (fig. 3). Thus formed the parts appear to function as an additional pair of copulatory appendages. The female possesses no single character of such distinction. The tibiae are yellow and the prealar bristle is long as in the male; the ovipositor has recurrent spinules on terminal sclerites, and unlike the male the apical posteroventral bristle of fore tibia is not bluntly capped.

During the course of years many male specimens have come to my attention which may be considered thus characterized. At first the differences evident in the structure and bristling of the fourth abdominal sternum of various specimens were considered as possible aberrations or variations within a single species, but recently as more material became available for study the so-called variations were found to adhere to definite patterns, so that individuals could be grouped in accordance with their conformation. Two segregates thus associated possessed additional characters that in my opinion warranted their separation as distinct species. The remainder were arranged into five groupings as subspecies of *setiventris*.

The different forms seem to coexist over much of the same territory, being distributed along mountain ranges of western North America and their adjacent terrain. The records reach as far north as Alaska and the North West Territories and south to Colorado, Nevada and middle California.

<sup>1</sup>Refers to literature cited in the references as indicated by year of publication.

<sup>2</sup>Stein in his original description refers to the second segment, and Malloch (1920) in his key refers mistakenly to the third abdominal sclerite.

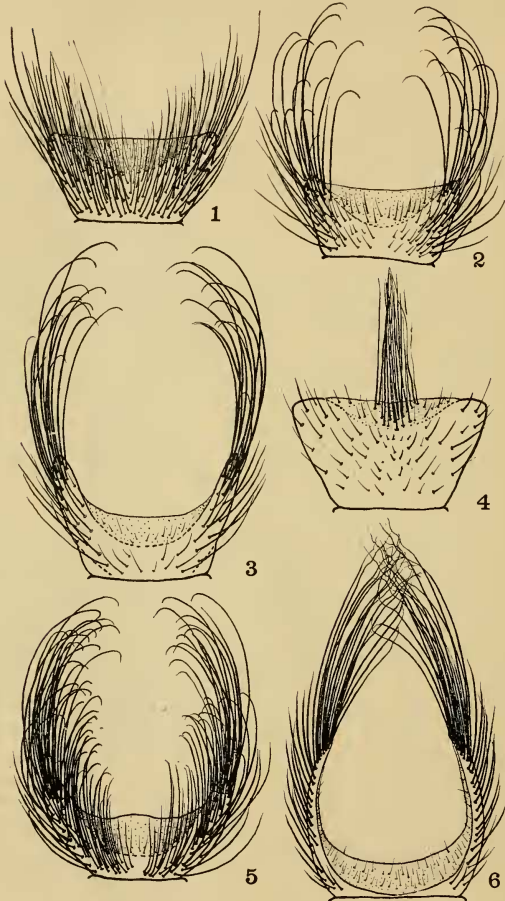


PLATE 36. FOURTH STERNITE OF MALE HYLEMYA

Fig. 1, *Hylemya (Delia) setiventris sobrians*; fig. 2, *Hylemya (Delia) setiventris alternata*; fig. 3, *Hylemya (Delia) setiventris setiventris*; fig. 4, *Hylemya (Delia) setiventris reliquens*; fig. 5, *Hylemya (Delia) setiventris rainieri*; fig. 6, *Hylemya (Delia) setiventris extensa*. (Drawings made from dried specimens.)

All that is known of the habits of the group, so far as I am aware, is contained on labels attached to certain specimens reared from *Lupinus*.

KEY TO SPECIES AND SUBSPECIES OF THE SETIVENTRIS-COMPLEX  
MALES

1. Frons bristled and eyes broadly separated as in female; arista subplumose; hind tibia with a robust apical posterodorsal bristle ..... 2  
     Frons not bristled and eyes not as widely separated as in female; arista pubescent; hind tibia with a weak setulose apical posterodorsal bristle ..... 3
2. Lamellae of fourth abdominal sternum with a caudal tuft of long bristles, flagellate at tips, remaining bristles short; hind tibia without a robust apical posteroventral bristle .....  
     ..... *inceptifrons*, new species  
     Lamellae fringed along entire length with a marginal series of long slender bristles, which are directed ventrad; hind tibia with a robust apical posteroventral bristle .....  
     ..... *setifirma*, new species
3. Fourth abdominal sternum deeply emarginate and extended laterocaudad as lobes or lamellae (figs. 3, 6), the latter partly overlapping fifth sternum ..... 4  
     Fourth sternum shallowly emarginate or not deeply depressed caudad, laterocaudal angles scarcely extended beyond caudal margin of fourth sternum (figs. 1, 2), and thus not partly overlapping fifth sternum ..... 6
4. Lamellae of fourth abdominal sternum fringed for greater part of their length with a loose marginal series of long slender bristles that are directed ventrad (fig. 5) .....  
     ..... *setiventris rainieri*, new subspecies  
     Lamellae not thus fringed, longer bristles grouped caudad and are directed caudad ..... 5
5. Lamellae extending to or caudad of a level with caudal margin of fourth abdominal tergum, tips of bristles flagellate and reaching beyond apex abdomen .....  
     ..... *setiventris extensa*, new subspecies  
     Lamellae not extending caudad to a level with caudal margin of fourth tergum, tips of bristles curving mesad and not reaching beyond apex of abdomen .....  
     ..... *setiventris setiventris* (Stein)
6. Bristles of fourth abdominal sternum limited to a median caudal tuft, remainder of sclerite having short sparse setae (fig. 4) ..... *setiventris reliquens*, new subspecies  
     Bristles of fourth sternum not arranged in a median caudal tuft, the sclerite having numerous long bristles ..... 7

7. Fourth abdominal sternum with longish bristles arranged laterad, the median area bare or only with short setulae (fig. 2) ..... *setiventris alternata*, new subspecies
- Fourth sternum with erect bristles on median and lateral areas, in no separated groups (fig. 1)
- ..... *setiventris sobrians*, new subspecies

## FEMALES

1. Hind tibia with a robust apical posterodorsal and posteroventral bristle..... *setifirma*, new species
- Hind tibia with a robust apical posterodorsal bristle, weak apical posteroventral..... *inceptifrons*, new species
- Hind tibia with weak apical posterodorsal and posteroventral bristles, neither equal to apical mid dorsal bristle ..... 2
2. Ovipositor without recurrent spinules on terminal sclerites, the setulae stiffish and fine; notopleural callosity with one or more setulae..... *setiventris extensa*, new subspecies
- Ovipositor with coarse recurrent spinules on terminal sclerites ... 3
3. Fore tibia usually with one median posteroventral bristle ... ..
- ..... *setiventris alternata*, new subspecies
- Fore tibia usually with two median posteroventral bristles ... .. 4
4. Notopleural callosity usually with one or more setulae .....
- ..... *setiventris rainieri*, new subspecies
- Notopleural callosity usually without setulae .....
- ..... *setiventris setiventris* (Stein)
- ..... *setiventris sobrians*, new subspecies
- ..... *setiventris reliquens*, new subspecies

**Hylemya (Delia) setiventris setiventris** (Stein)

*Hylemya setiventris* Stein, 1898. Berl. Ent. Ztschr., (1897) 42 (3-4): 216-218.

The species has been so fully described by Stein that there seems little need for additional remarks. The structure and bristling of the fourth abdominal sternum of male has been noted in greater detail at the beginning of this paper, and is also illustrated for purposes of comparison (fig. 3). Although the female tibiae are always yellow in *setiventris* and its subspecies the femoral coloration is not so consistent, mid and hind pairs frequently being partly infuscated. So far I have failed to find any tangible characters in this sex for the separation of *setiventris*, *sobrians* and *reliquens*.

ALASKA: ♂, Camp 327, Alaska Eng. Comm., July 12, 1921 (J. M. Aldrich) [U. S. N. M.].

ALBERTA: ♀, Waterton, July 9, 1923 (H. L. Seamans) [C. N. C.].

BRITISH COLUMBIA: ♂, Keremeos, August 2, 1923, ♂, ♀, Hedley, August 29, 1923 (C. B. Garrett) [C. N. C.].

IDAHO: ♂, 2 ♀, Moscow, cotypes, ♂, Lake Waha, July 22, 1927 (J. M. Aldrich) [U. S. N. M.]. ♂, 3 ♀, Mountains, Moscow, July 25, 1930 (R. C. Shannon).

MONTANA: 2 ♂, Beaver Creek, 6300 ft. alt., August, 1913 (S. J. Hunter) [Univ. Kans.]. ♂, Florence, June 1, 1912 (Mont. Exp. Sta.).

UTAH: ♂, ♀, Logan Canyon, July 30, 1940 (Stains & Hall) [Utah State Coll.].

WASHINGTON: ♂, Spokane, June 24, 1930 (J. M. Aldrich), ♂, Pullman, June. [U. S. N. M.]. ♂, Field Springs State Park, near Anatone, June 12, 1949, ♂, Lewiston Grade, 1800 ft. alt., June 2, 1949. ♀, Tipsoo Lakes, Chinook Pass, August 27 1949 (M. T. James) [State Coll. Wash.].

### *Hylemya (Delia) setiventris alternata*, new subspecies

Male differing essentially from those of other subspecies in structure and bristling of fourth abdominal sternum as illustrated in figure 2. The lateral lobes are less pronounced and do not extend caudad of a level with the depressed caudal border of fourth sternum; bristles are arranged in two groups along lateral borders of sternum, and are all longish and have their tips curved inward, those on cephalic half erect and directed ventrad when viewed from the side, those on caudal half gradually becoming recumbent and directed caudad.

Mesonotum with distinct sheen, more so than in *setiventris*, and with significantly fewer setulae along lateral declivities and planes of dorso-central bristles. Abdomen more densely and extensively yellowish gray, with the dorso-central vitta restricted to narrower proportions than in *setiventris*. Fore tibia with one median posteroventral bristle. Wing veins mostly yellowish brown. Length, 7 mm.

Female, with mesonotum as in male; mesopleura with a weak but well marked bristle below anterior notopleural bristle. Abdominal pruinescence as in male, dorso-central marking weakly apparent or undeveloped. Wings more extensively yellowish tinged than in *setiventris*, and with a stronger costal series of setulae. Fore tibia with one median posteroventral bristle. Length, 8 mm.

Holotype: ♂, Silverton Hills, Marion County, Oregon, June 5, 1940 (R. E. Rieder) [U. S. N. M.]. Allotype: ♀, Yale, Idaho, September 10, 1912 [U. S. N. M.]. Paratypes: ♂, Consort, Alberta, July 18, 1947 (E. H. Strickland), ♀, Rockyford, Alberta, August 15, 1941 (W. R. Mason) [C. N. C.].

ALASKA: ♀, Camp 327, Alaska Eng. Comm., July 13, 1921 (J. M. Aldrich) [U. S. N. M.].

ALBERTA: ♂, Vermilion, June 23, 1938 (E. H. Strickland); ♀, Waterton, July 9, 1923 (H. L. Seamans) [C. N. C.].

COLORADO: ♀, Pingree Park, (V. M. Tanner). ♀, Poudre Canyon, August 23, 1940 (Knowlton & Nye) [Utah State Coll.].

IDAHO: 3 ♀, Yale, September 10, 1912 (J. M. Aldrich) [U. S. N. M.]. ♀, Mts., Moscow, July 25, 1920 (R. C. Shannon).

OREGON: ♂, Eagle Creek, Post Office, July 4, 1940 (Gray & Schuh),

♀, Crater Lake, South rim, 7100 ft. alt., July 30, (H. A. Scullen) [Ore. State Coll.].

SOUTH DAKOTA: 2 ♀, Custer, July 22, 1924.

UTAH: ♀, Garden City, August 25, 1938 (Knowlton & Hardy), ♀, Mt. Home, July 19, 1940 (G. F. Knowlton), ♂, Fish Lake, July 10, 1943 (Knowlton & Telford) [Utah State Coll.].

WYOMING: ♂, near Leander, 5000-8000 ft. alt., July, ♂, ♀, 12 mi. N. W. Lusk, July, 1895 [Univ. Kans.], ♀, Summit, Albany County, 8500 ft. alt., August 10, 1950 (R. R. Dreisbach).

**Hylemya (Delia) setiventris sobrians**, new subspecies

Male differing essentially from those of other subspecies in structure and bristling of fourth abdominal sternum as illustrated in figure 1. In structure the sternum most closely resembles that of *alternata*, but differs in that it is entirely covered with bristles. In other respects the subspecies agrees with *setiventris*. Length 7.5 mm.

Holotype: ♂, Mount Moscow, Idaho, June 6, 1930 (J. M. Aldrich) [U. S. N. M.].

COLORADO: ♂, Brainherd Lake, Ward, August 8, 1950 (Dreisbach & Schwab).

IDAHO: ♂, Mount Moscow, June 10, 1930 (J. M. Aldrich) [U. S. N. M.], 3 ♂, Mts., Moscow, June 15, 1920 (R. C. Shannon).

UTAH: ♂, Eureka, June 24, 1933 (G. F. Knowlton), ♂, Logan, June 13, 1933, ♂, Trenton, June 11, 1938 (Knowlton & Nye).

WASHINGTON: ♀, Sprague, June 20, 1920 (R. C. Shannon).

**Hylemya (Delia) setiventris reliquens**, new subspecies

Male, readily distinguished from those of other subspecies by the comparatively simple development of fourth abdominal sternum, and by the peculiar arrangement of bristles. The latter are confined to a median fascicle of slender bristles caudad, the remaining vestiture being weak and sparse (fig. 4). In other respects the subspecies is similar to *setiventris*. Length, 7.5 mm.

Holotype: ♂, Mountains, Moscow, Idaho, July 15, 1920 (R. C. Shannon) [U. S. N. M.].

**Hylemya (Delia) setiventris rainieri**, new subspecies

Male differs superficially from that of *setiventris* in being distinctly blackish, abdomen with broader dorsocentral marking and wider anterior tergal incisions, femora and tibiae blackish, or hind tibiae rufous, knees reddish, wings fuscous tinged and blackish basad, calyptreae brownish, halteres yellow.

Fourth abdominal sternum deeply emarginate caudad, constricting the remainder of the sclerite, lateral lobes or lamellae well developed, as in *setiventris*. The lamellae are fringed along their entire length with a dense series of erect slender bristles, which tend to become recumbent caudad when viewed from the side. Tips of bristles curving mesad and not reaching beyond apex of abdomen.

Bristling of thorax and legs as in *setiventris*, except that notopleural callosity has invariably one or more setulae. Length, 6.5 mm.

Female paler grayish brown or grayish as in *setiventris*, with mid and hind femora at least partly reddish yellow and all tibiae entirely so. Wings clear or lightly tinged. In structure slightly more robust than *setiventris*, parafacials in profile being well maintained ventrad, at narrowest width exceeding breadth of third antennal segment, notopleural callosity with one or more setulae. Length, 7 mm.

Among the following specimens of *rainieri* there are two males from the Big Horn Mountains which differ notably in their paler grayish appearance, clear wings, successively more yellowish mid and hind tibiae, and in the absence of setulae on notopleural callosity. They agree however with other males in the character of the fourth abdominal sternum, the only apparent difference in my opinion being that the bristles are slightly denser and longer. I have regarded these specimens as variants of *rainieri*.

Holotype: ♂, Mt. Rainier, Summerland Trail, Washington, July 24, 1924 (A. L. Melander) [U. S. N. M.]. Allotype: ♀, Mt. Rainier, Sunrise Trail, 6400 ft. alt., Washington, July 29, 1933 (J. Wilcox) [U. S. N. M.]. Paratypes: ♂, St. Marys, British Columbia, July 12, 1926 (A. A. Denny), ♀, Hedley, British Columbia, July 20, 1923 (C. B. Garrett) [C. N. C.].

BRITISH COLUMBIA: ♂, Barkerville, August 2, (N. Criddle), ♂, Revelstoke Mountain, 6000 ft. alt., August 12, 1923 (E. R. Buckell) [C. N. C.].

CALIFORNIA: ♂, Giant Forest, 6800 ft. alt., July 1, 1928 (E. A. McGregor) [U. S. N. M.].

MONTANA: ♂, ♀, Big Horn Mountains, August 20, 1926 (G. Cady).

NORTH WEST TERRITORIES: ♂, Reliance, June, 1937 (W. J. G. Stewart).

OREGON: ♂, Larch Mountain, July 18, 1940 (Gray & Schulz) [Ore. State Coll.].

WASHINGTON: ♀, Mt. Rainier, Tipsoo Lake, September 10, 1935 (J. Wilcox), 2 ♀, Paradise Inn, August 17, 1930.

WYOMING: ♂, Big Horn Mountains, August 23, 1934 (C. P. Alexander).

#### ***Hylemya (Delia) setiventris extensa*, new subspecies**

Male, black, markings as in *rainieri*; legs black, mid and hind tibiae blackish or reddish, wings blackish basad; notopleural callosity with one or more setulae; fourth abdominal sternum deeply emarginate caudad and with longer lateral lamellae than in *rainieri*, each bearing an apical tuft of slender bristles, the tips of which are flagellate and reach beyond apex of abdomen, remaining bristles shorter, tips fine (fig. 6). Bristling of thorax and legs similar to that of *setiventris*, mid metatarsus with a coarse series of longer setulae along dorsum.

Female paler, mesonotum brownish and abdomen densely yellowish gray; femora partly or wholly yellowish, tibiae yellowish; wings slightly yellowish tinged. Notopleural callosity usually with one or more setulae; terminal sclerites of ovipositor with spinules nonrecurrent, fine and erect as stiffish setulae. Bristling of throat and legs as in *setiventris*. Length, 7.5 mm.

The males listed below from Hood River and Mount Rainier differ notably from remaining males in their paler grayish appearance and clear wings, and in having all tibiae reddish yellow and mid and hind femora yellowish on distal region. The structure and bristling of fourth abdominal sternum agrees with that of *extensa*, and mainly on this account I have tentatively regarded them as variants of *extensa* rather than subspecifically distinct.

Holotype and Allotype: ♂, ♀, Anchorage, Alaska, July 20, 1921 (J. M. Aldrich) [U. S. N. M.]. Paratypes: ♂, ♀, Multnomah, Oregon, pupae around Russell Lupine crowns, May 8, 1941; emerged in laboratory May 19, 1941, J. Schuh) [Ore. State Coll.].

ALASKA: ♂, Seward, July 24, 1921 (J. M. Aldrich) [U. S. N. M.]. 3 ♂, 3 ♀, Katmai, August-September, 1917 (J. S. Hine).

CALIFORNIA: ♀, Yosemite National Park, August 1, 1940, ♂, Bishop, July 28, 1940 (R. H. Beamer) [Univ. Kans.].

IDAHO: ♀, Yale, September 10, 1912 (J. M. Aldrich) [U. S. N. M.].

MONTANA: ♀, Gallatin Mountains, August 24, 1917.

OREGON: ♂, Hood River, August 1, 1917 (Childs). ♀, Silver Creek Falls, Marion County, October 8, 1940 (R. E. Rieder) [Ore. State Coll.]. ♀, Lick Creek RS., Wallowa National Forest, 4600 ft. alt., August 16, 1937 (Bolinger-Jewett). ♂, 4 ♀, Portland, May 13, 1944, *ex lupine*, (Anderson), ♂, Forest Grove, June 13, 1919, *ex Lupinus leucophilus*, (L. P. Rockwood) [U. S. N. M.].

WASHINGTON: ♂, ♀, Mt. Rainier, Yakima Park, July 22, 1924 (A. L. Melander).

#### **Hylemya (Delia) ineptifrons, new species**

Male: parafrontals, parafacials and cheeks seal brown with more or less reddish ground color, interfrontalia reddish cephalad; face, occiput, thorax and abdomen pale gray. Antennae blackish, second segment reddish distad, palpi reddish brown, darker at apex. Mesonotum with poorly defined streaks along planes of dorsocentral bristles; abdomen with a weak dorsocentral vitta; fore femora blackish, mid and hind femora largely or entirely yellowish, all tibiae yellowish, tarsi brownish. Wings and calypterae hyaline, halteres yellow.

Eyes widely separated apart, frons and vertex of head bristled as in female, parafacials at base of antennae and cheeks as wide and high respectively as width of third antennal segment, the former narrower at middle, arista densely subplumose on proximal half and shorter haired distad, longer hairs nearly equal to width of third antennal segment.



Mesonotum sparsely setulose along lateral declivities and also on scutellum, with a robust pair of presutural acrostical bristles, remaining acrosticals lacking except for caudal pair, prealar bristle long, notopleural callosity devoid of accessory setulae, sternopleural bristles arranged 1:2. Abdomen subovate, largely depressed, fourth sternum deeply emarginate and strongly constricted at middle, lateral lamellae extended caudad to reach a level with caudal margin of tergum 4, and armed at apex with a tuft of long bristles, the tips of which are flagellate and reach beyond apex of abdomen.

Fore tibia with 2 posteroventral bristles, apical posteroventral robust and blunt, mid tibia with 1 or 2 fine anterodorsal and 2 fine posteroventral bristles, 2 robust posterodorsal bristles, the proximal bristle being notably the longer, hind femur with anteroventral bristles confined to distal half of femur, posteroventral bristles absent, hind tibia with 3 anteroventral, 4 anterodorsal, 3 posterodorsal bristles, posteroventral series of setulae lacking, apical posterodorsal robust, equal to apical mid dorsal bristle, mid metatarsus with a dorsal series of coarse longer setulae (most noticeable in paratype). Costal thorn as long as *r-m* cross vein, *m-cu* cross vein semierect and slightly sinuate. Length, 6 mm.

Female, similar to male except for sexual characters, parafacials at base of antennae and cheeks wider and higher respectively than breadth of third antennal segment, arisal hairs shorter, longer hairs being about equal to half width of third antennal segment. Terminal sclerites of ovipositor armed with several weak recurrent spinules. Fore tibia with a mid anterodorsal and 2 posteroventral bristles, apical posteroventral pointed apicad, mid tibia with 2 anterodorsal, 2 posterodorsal and 2 posteroventral bristles, distal anterodorsal being notably robust, hind femur with anteroventral bristles extending to proximal half of femur, hind tibia with 2 to 4 anteroventral, 4 and 5 anterodorsal, 3 to 5 posterodorsal bristles. Wings and calyptrae slightly yellowish tinged. Length, 7 mm.

This species and the following possess the inhabitus of *setiventris* and its subspecies despite the distinctive bristling on hind tibiae and the dichoptic character of male head. The plastic nature of the characters developed in these forms is further suggested by the anomalous differences in length of arisal hairing between the sexes, being longer in male than in female.

Holotype: ♂, Asotin, Washington, June 27, 1932 (J. M. Aldrich) [U. S. N. M.]. Allotype: ♀, Waha, Idaho, August 12, 1923 (A. L. Melander) [U. S. N. M.]. Paratypes: ♂, Angel Creek, Wells, Nevada, June 23, 1927 (J. M. Aldrich) [U. S. N. M.]. ♀, Laketown, Utah, September 21, 1938 (Knowlton & Harmston) [Utah State Coll.].

#### **Hylemya (*Delia*) setifirma, new species**

Male; similar to that of *ineptifrons*, differing essentially in the following respects: Fourth abdominal sternum more extensively emarginate

caudad, caudal membrane lining the lamellae with several delicate hairs, inner (ventral) border of lamellae completely fringed with a dense series of slender erect bristles, which become longer and coarser apicad, bristles curving mesad and becoming recumbent. Mid tibia with or without a mid anterodorsal bristle, hind tibia with a robust apical posterodorsal and posteroventral bristle, and with a sparse series of posteroventral setulae, mid tarsus spatulate, segments 3 and 4 slightly broadened, hind metatarsus with a prominent series of spinulose setulae on anteroventral surface. Length, 6 mm.

Female similar to male except for sexual characters, longer arisal hairs nearly equal to width of third antennal segment, palpi yellowish to reddish brown, ovipositor with recurrent spinules on terminal sclerites. Mid tibia in allotype has a mid anterior bristle, hind tibia with apical posteroventral and posterodorsal bristles robust, mid tarsal segments 3 and 4 not so distinctly broadened. Length, 7.5 mm.

Holotype: ♂, Wallowalk, Oregon, September 9, 1932 (Itol Wilcox) [U. S. N. M.]. Allotype: ♀, Logan Canyon, Utah, July 30, 1940 (Stains & Hall) [U. S. N. M.]. Paratypes: ♂, Viola, Idaho, June 26, 1912 (J. M. Aldrich) [U. S. N. M.]. ♀, Grand Teton National Park, Wyoming, August 18, 1931 (R. H. Beamer) [Univ. Kans.]. 2 ♂, Aneroid Lake, Oregon, August 1, 1941 (R. E. Rieder), ♂, ♀, Bighorn Mountains, Montana, August 20, 1926 (G. Cady), ♂, Rocky Mountain National Park, Colorado, August 25, 1934 (C. P. Alexander), ♀, Maybell, Colorado, June 30, 1931 (L. D. Anderson), 2 ♀, Tahoe Lake, Nevada, October 5, 1935 (A. J. Basinger).

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- Stein, P., 1898. Nordamerikanische Anthomyiden. Beitrag zur Dipterenfauna der Vereinigten Staaten. Berl. Ent. Ztschr. (1897) 42(3-4): 216-218.

#### BOOK NOTICE

**RECENT ADVANCES IN THE STUDY OF THE ORIENTATION OF THE HONEY BEE**, by K. von Frisch. In *Bul. Animal Behavior*, vol. 1, no. 9, pp. 1-33, 1951 (England).

This number of the Bulletin contains translations by Dr. Ilse of von Frisch's three most recent papers (1948-1950) on the senses and language of the honey bee. The information has been summarized in the recently published "Bees, Their Vision, Chemical Senses and Language."

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